

NASA Developed AIDC Products



Fred Schramm
Engineering Directorate
NASA Marshall Space Flight Center

**Department of Defense UID
IPT**

June 3, 2005



***NASA Thanks Those Who
Protect Our Freedom***

Direct Part Marking

DoD.....NASA..... Work Together

History of Collaboration

Part Marking Project

**1984 laser etching studies by the
USAF (Jane Channell) with NASA**

**1984-1988 Air Force provided
consulting services for Shuttle DPM**

**2001 DoD, NASA and others
developed the DPM Standard 6002
and Handbook 6003**

**2002 - 2005 DoD and USCG work with
NASA and licensees...NCMS marking
development and pilot studies**

**2005- UID initiative explores
common ground**

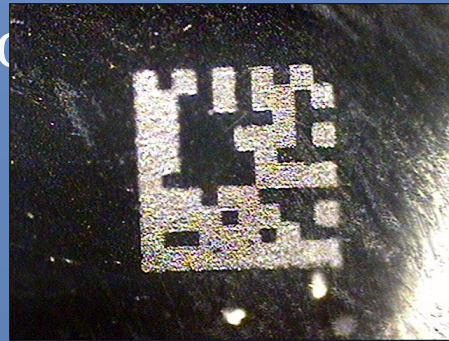
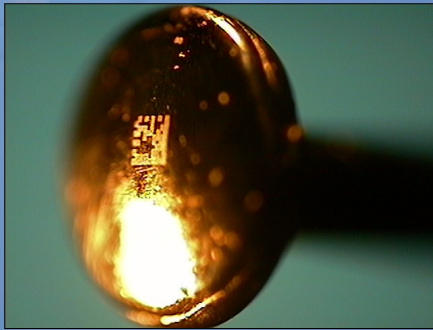


NASA Direct Part Marking

Project

**“Challenger Return to Flight” Configuration Mgt Imp
2001 Result...NASA Standard and Handbook**

NASA's Primary Emphasis
....Item-Level
Traceability



....Track the

**Left: 10x10 matrix symbol
head of a straight pin**

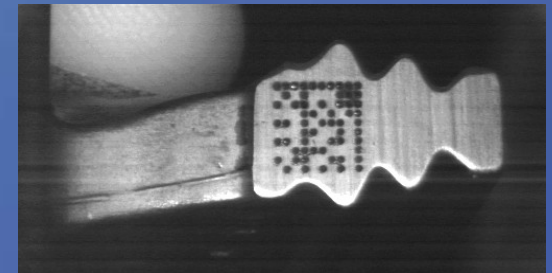
**Below: 10x10 matrix symbol
the side of a turbine blade**

Know the Pedigree

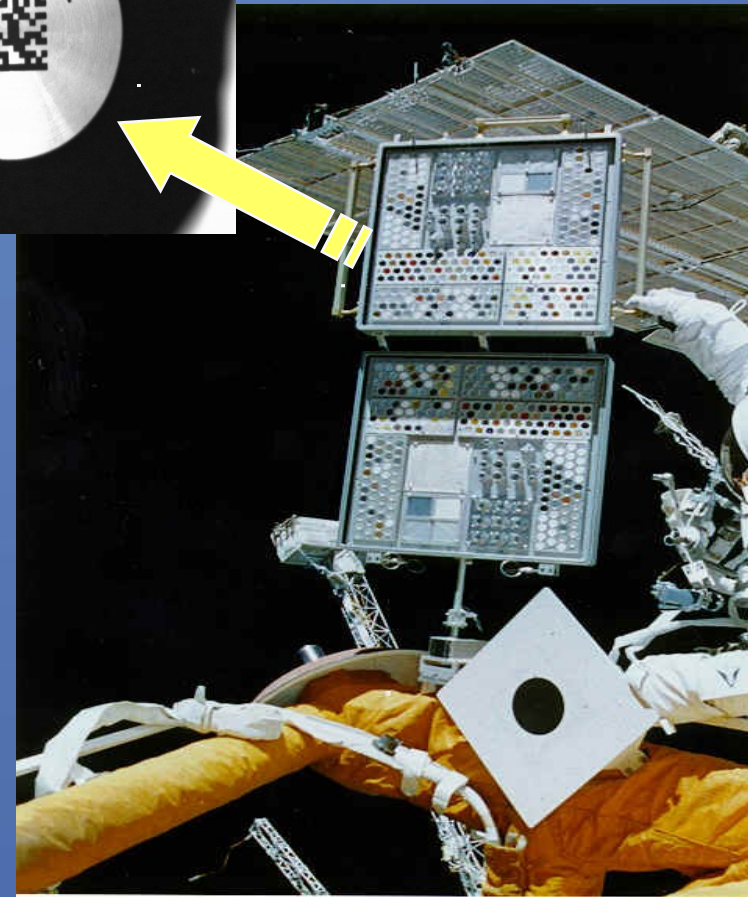
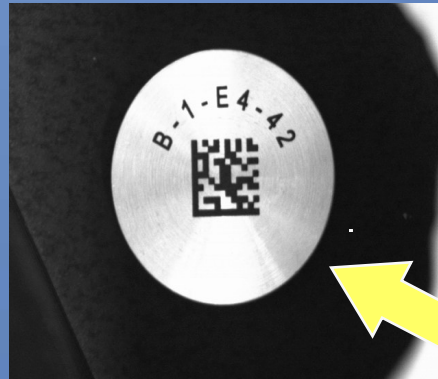
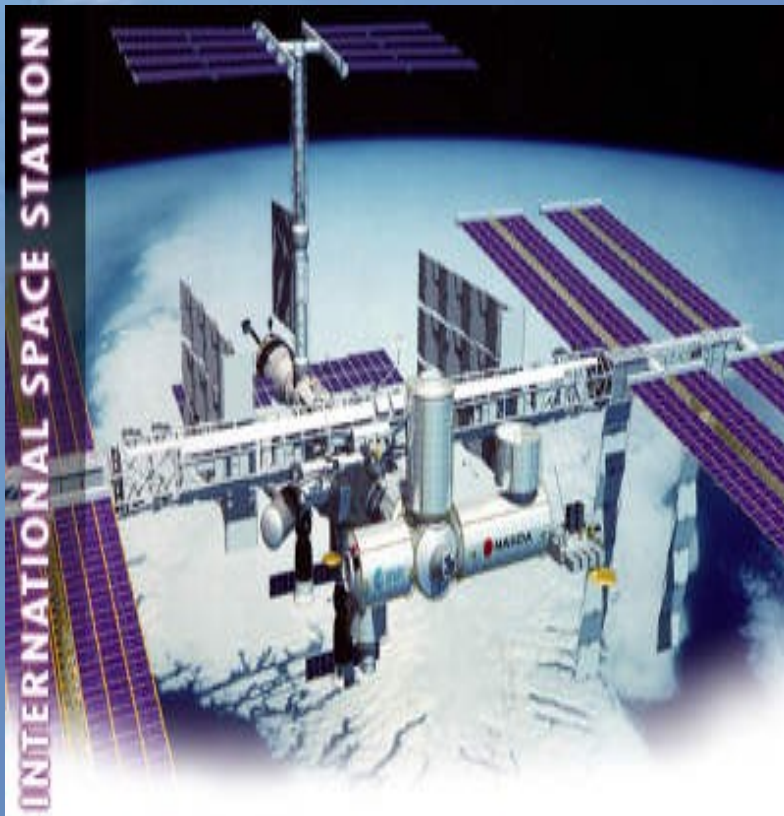
....Know who made it

....Know who marked it

....Know who stands behind it

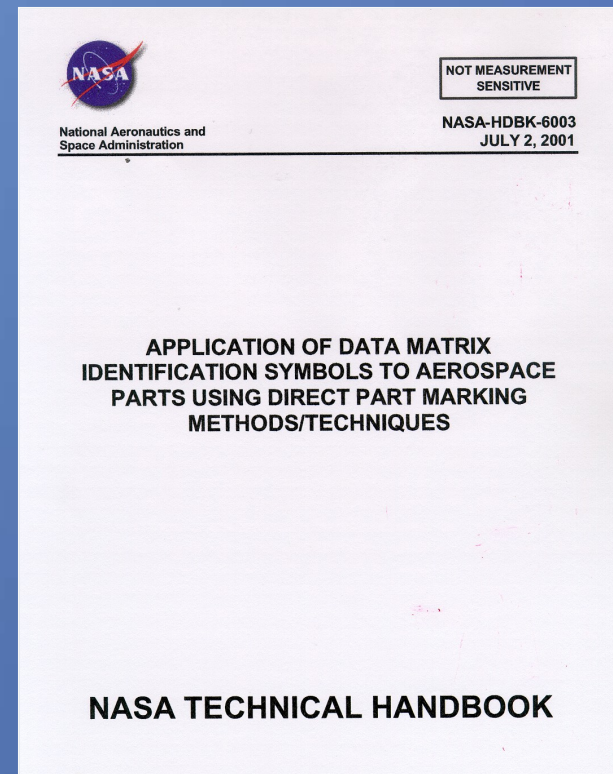
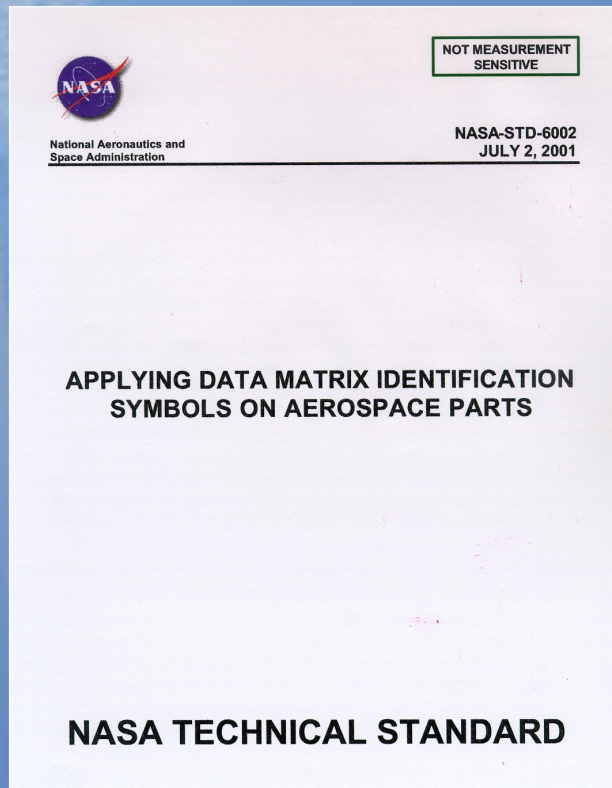


International Space Station Materials Experiment



Project

A Direct Part Marking Standard 6002 and Handbook Currently in final review for Revision B



<http://standards.nasa.gov>
Free Download...Public Site

Read Through Paint

Welcome to The CTMA Connector, a monthly newsletter designed to provide news and ideas about the Commercial Technologies for Maintenance Activities (CTMA) program. The CTMA program is a joint Department of Defense/National Center for Manufacturing Sciences (DoD/NCMS) effort promoting collaborative technology development between industry and the DoD maintenance and repair facilities. This newsletter highlights ongoing projects, serves as a forum for promoting new project ideas, and provides other news of interest to the program.



Direct Part Marking (DPM) For High Strength Metals and Painted Over Articles

Problem: DPM of high strength metals & painted over articles is difficult. The overhaul cycles of the high strength steel components typically require shot blast or a grit blast process that only a fused on data symbol can survive. Other parts requiring Direct Part Marking requires the data symbol to get covered with paint to protect the part from corrosion. The problem is to find a non-invasive method that allows for the rapid fusion of a DPM to high strength metal substrates. Another related problem is to find a way to apply direct part marks to paint over articles allowing the data symbol to be read through the paint

Solution: Find a non-invasive method that allows for the rapid fusion of a DPM to high strength metal substrates.

NCMS Contact: Steve Hale, steveh@ncms.org, 734-995-2195

May 2005

NASA Read-Through-Paint

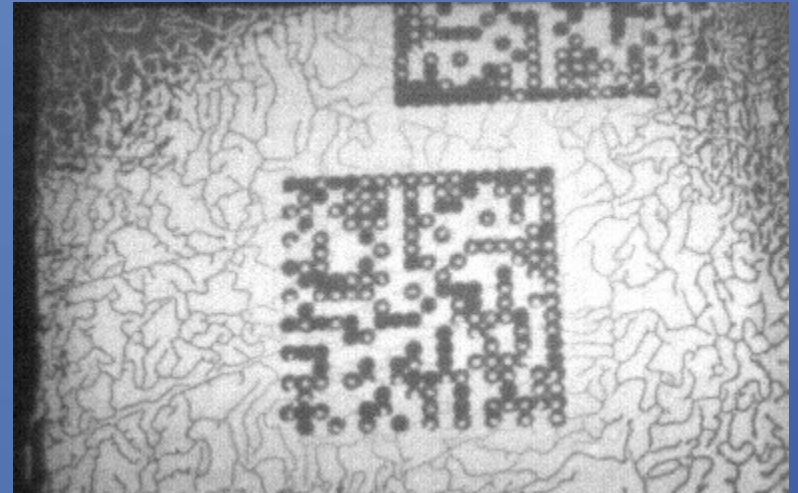
Magnet



Handheld Reader

A portable magnetic scanner about the size of a hair dryer

Decodable images (right) through 15 mils of copy paper or paint (6 layers)



*Commercially available
Licenses available*

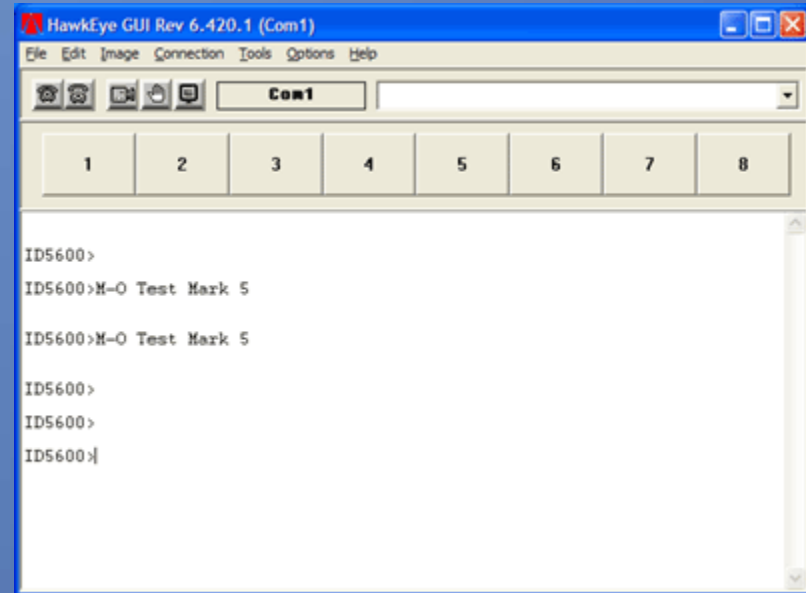
Licenses: DMSI

ASA Read-Through-Paint Products

Magnetic Marks on Coast Guard Plane Door



Mark Survived 8 Months of Duty



Mark Decoded

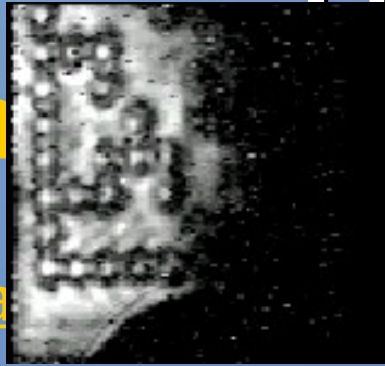


Mark Easily Imaged

NASA Read-Through-Paint Products



Ultrasonic Handheld Read-Through-Paint



A portable ultrasonic
scanner about the
size
of a hair dryer

Decodable images
(right) through 15
mils of copy paper or
paint (6 layers)

Commercially available
Licenses available

AcoustoCam™ I400

Ultrasound Imaging Camera



* PC not included

For Nondestructive
Testing of Materials

System Overview

What is it?

The AcoustoCam™ I400 is a novel ultrasound camera system provides inspectors with a real time view of subsurface faults. This represents a user friendly alternative to an A-scan thickness gauge or flaw detector.

What is it used for?

The AcoustoCam™ I400 can immediately provide information about subsurface faults including:

- Corrosion
- Cracking
- Voids
- Impact Damage
- Delaminations

How is it used?

Inspectors need only put some ultrasound gel up to the part under study, place the AcoustoCam™ I400 probe up to the part and begin imaging. The images are shown on an LCD integrated into the back of the unit. Once a fault is detected, the image can be saved for later evaluation.

Technical Specifications

Included Components:

- Camera subassembly with imaging array, F/1 acoustic lens, source transducer, pulser control unit, sample focusing target, cables, User's manual

Frame Rate:

-30 fps

Ultrasound Dynamic Range:

-14 bits

Grey Levels:

-256

Frequency Response:

-1 to 4 MHz

Video Output:

-RS170 EIA

Operating Temp. Range:

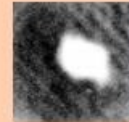
-32° to 104°F (0° to 40°C)

Storage Temp Range:

-32° to 104°F (0° to 40°C)

Power:

-120V AC



This image of a void
inside of a composite
material was taken in
1/30 second.



Specifications subject to change without notice



Imperium, Inc.
1738 Elton Road, # 218
Silver Spring, MD 20903
(301) 431-2905
(301) 431-0200

Email: sales@imperiuminc.com

Web: <http://www.imperiuminc.com>

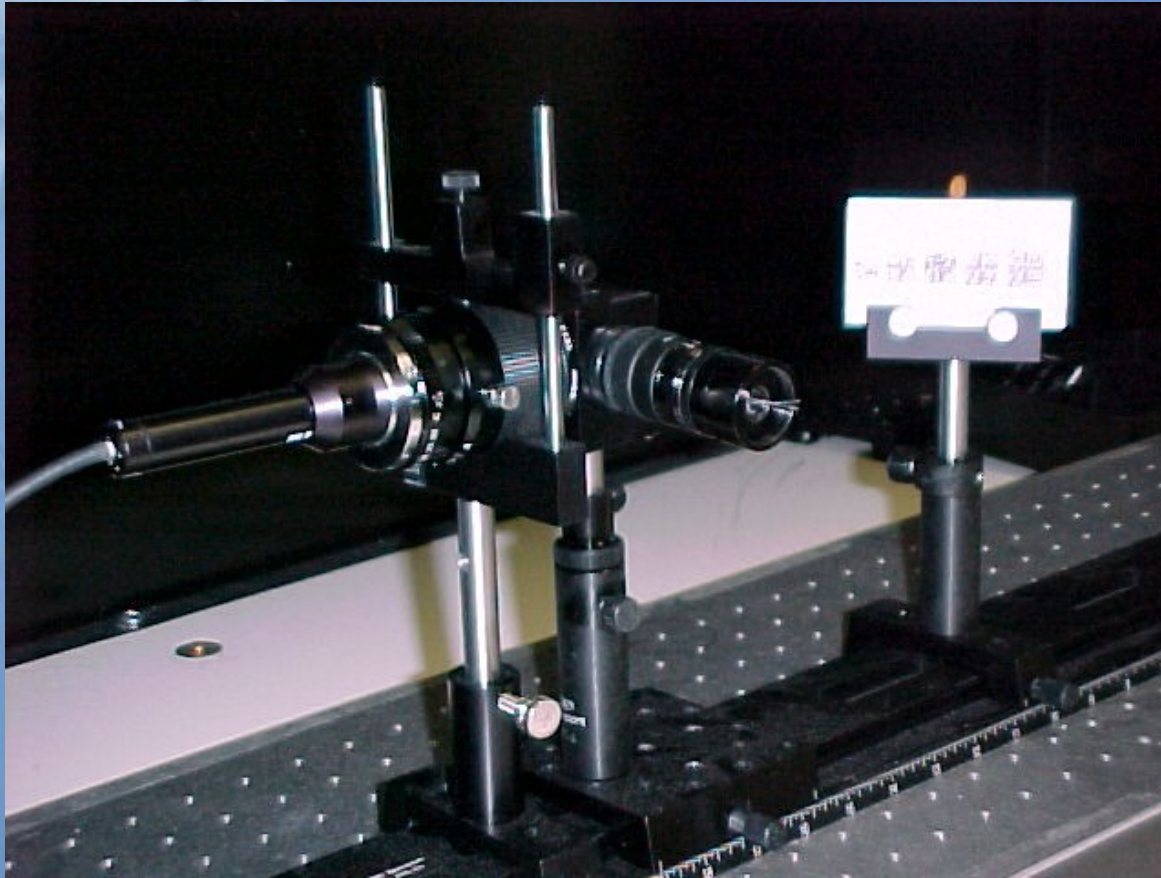




Autofocus

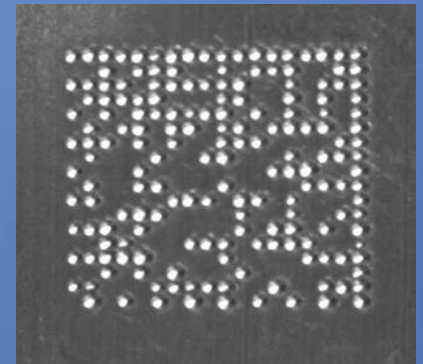
Angular and Distance Reads

Autofocus Distance Scanner



**NASA Optical
Scanner
For Visible Marks**

*Licenses
available*



**No contrast
mark
on smooth
aluminum**



**Shiny
screwdriver**

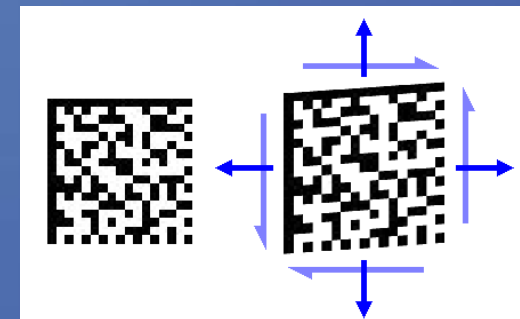
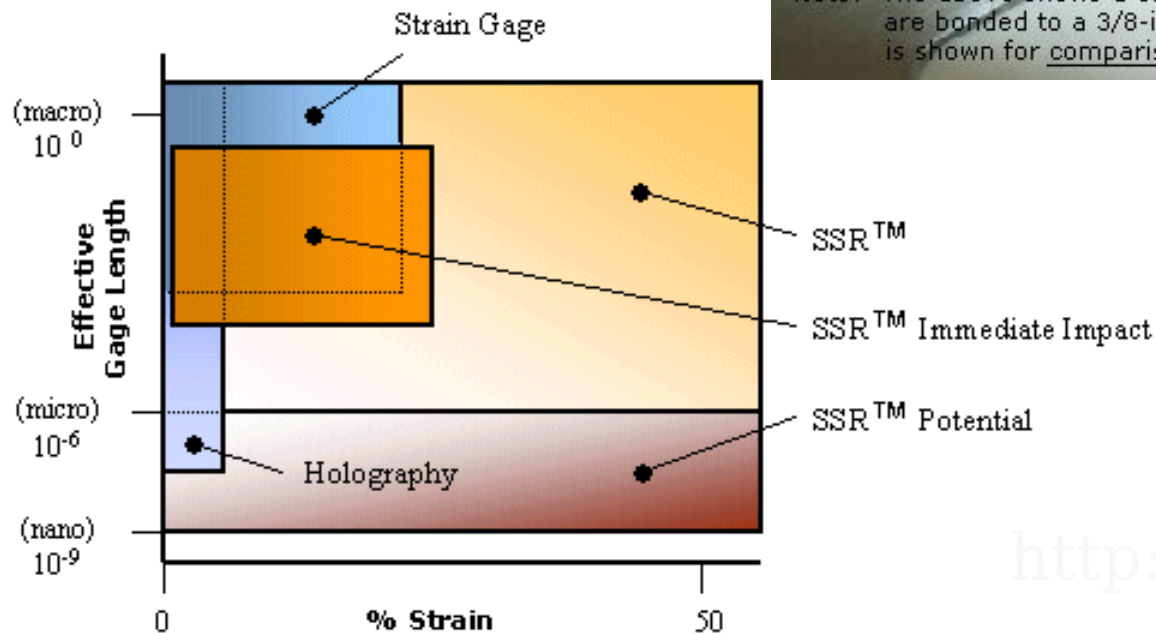
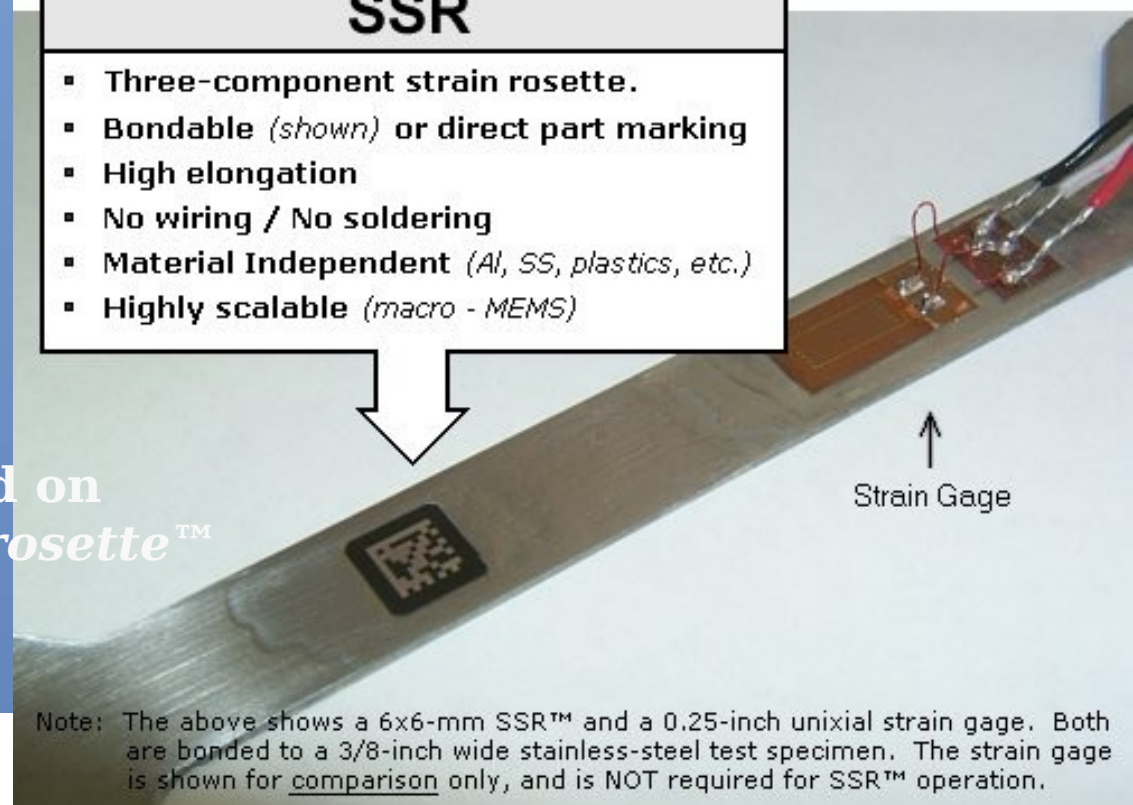
A faint, light blue background image on the left side of the slide shows a hand dropping a coin into a body of water, with concentric ripples emanating from the point of impact.

Stretch Codes

Unusual Applications

Direct Measurements, Inc. introduced a universal strain-gage alternative based on proprietary *symbolic strain rosette*[™] (or SSR[™]) technology.

- SSR[™]**
- Three-component strain rosette.
 - Bondable (*shown*) or direct part marking
 - High elongation
 - No wiring / No soldering
 - Material Independent (*Al, SS, plastics, etc.*)
 - Highly scalable (*macro - MEMS*)



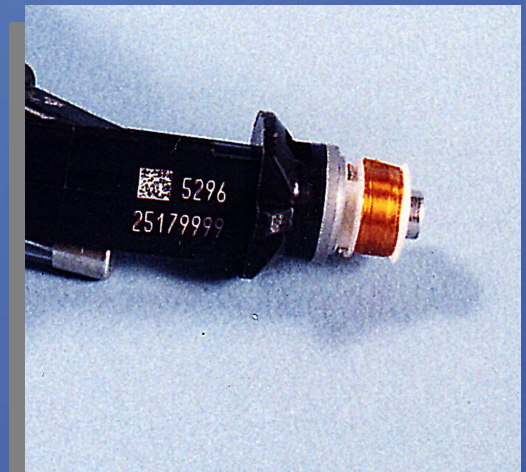
<http://directmeasure.com/>

A faint, light blue background image on the left side of the slide shows a hand dropping a coin into a body of water, with concentric ripples emanating from the point of impact.

NanoCodes

Nanocodes

X-ray Fluorescence....
A New Way To Find.....
.....Unapproved Part



Nanocodes

Standard XRF Detection Range

Titanium, Nickel, Steel alloys

General analyses for heavier elements

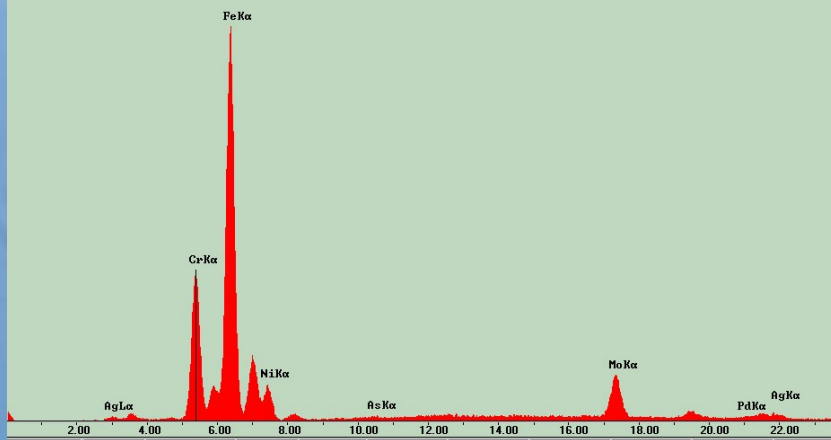


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*Licensee:
KeyMaster
Technologie*

Nanocodes

X-Ray Fluorescent Spectral Data Output



< =

Periodic Table and X-Ray Energies

<div> <div> <div>1</div> <div>H</div> <div>Hydrogen</div> </div> <div> <div>2</div> <div>He</div> <div>Helium</div> </div> </div>																		<div> <div>3</div> <div>Li</div> <div>Lithium</div> </div> <div> <div>4</div> <div>Be</div> <div>Beryllium</div> </div> <div> <div>5</div> <div>B</div> <div>Boron</div> </div> <div> <div>6</div> <div>C</div> <div>Carbon</div> </div> <div> <div>7</div> <div>N</div> <div>Nitrogen</div> </div> <div> <div>8</div> <div>O</div> <div>Oxygen</div> </div> <div> <div>9</div> <div>F</div> <div>Fluorine</div> </div> <div> <div>10</div> <div>Ne</div> <div>Neon</div> </div>																	
<div> <div>11</div> <div>Na</div> <div>Sodium</div> </div> <div> <div>12</div> <div>Mg</div> <div>Magnesium</div> </div> <div> <div>13</div> <div>Al</div> <div>Aluminum</div> </div> <div> <div>14</div> <div>Si</div> <div>Silicon</div> </div> <div> <div>15</div> <div>P</div> <div>Phosphorus</div> </div> <div> <div>16</div> <div>S</div> <div>Sulfur</div> </div> <div> <div>17</div> <div>Cl</div> <div>Chlorine</div> </div> <div> <div>18</div> <div>Ar</div> <div>Argon</div> </div>																		<div> <div>19</div> <div>K</div> <div>Potassium</div> </div> <div> <div>20</div> <div>Ca</div> <div>Calcium</div> </div> <div> <div>21</div> <div>Sc</div> <div>Scandium</div> </div> <div> <div>22</div> <div>Ti</div> <div>Titanium</div> </div> <div> <div>23</div> <div>V</div> <div>Vanadium</div> </div> <div> <div>24</div> <div>Cr</div> <div>Chromium</div> </div> <div> <div>25</div> <div>Mn</div> <div>Manganese</div> </div> <div> <div>26</div> <div>Fe</div> <div>Iron</div> </div> <div> <div>27</div> <div>Co</div> <div>Cobalt</div> </div> <div> <div>28</div> <div>Ni</div> <div>Nickel</div> </div> <div> <div>29</div> <div>Cu</div> <div>Copper</div> </div> <div> <div>30</div> <div>Zn</div> <div>Zinc</div> </div> <div> <div>31</div> <div>Ga</div> <div>Gallium</div> </div> <div> <div>32</div> <div>Ge</div> <div>Germanium</div> </div> <div> <div>33</div> <div>As</div> <div>Arsenic</div> </div> <div> <div>34</div> <div>Se</div> <div>Selenium</div> </div> <div> <div>35</div> <div>Br</div> <div>Bromine</div> </div> <div> <div>36</div> <div>Kr</div> <div>Krypton</div> </div>																	
<div> <div>37</div> <div>Rb</div> <div>Rubidium</div> </div> <div> <div>38</div> <div>Sr</div> <div>Strontium</div> </div> <div> <div>39</div> <div>Y</div> <div>Yttrium</div> </div> <div> <div>40</div> <div>Zr</div> <div>Zirconium</div> </div> <div> <div>41</div> <div>Nb</div> <div>Niobium</div> </div> <div> <div>42</div> <div>Mo</div> <div>Molybdenum</div> </div> <div> <div>43</div> <div>Tc</div> <div>Technetium</div> </div> <div> <div>44</div> <div>Ru</div> <div>Ruthenium</div> </div> <div> <div>45</div> <div>Rh</div> <div>Rhodium</div> </div> <div> <div>46</div> <div>Pd</div> <div>Palladium</div> </div> <div> <div>47</div> <div>Ag</div> <div>Silver</div> </div> <div> <div>48</div> <div>Cd</div> <div>Cadmium</div> </div> <div> <div>49</div> <div>In</div> <div>Indium</div> </div> <div> <div>50</div> <div>Sn</div> <div>Tin</div> </div> <div> <div>51</div> <div>Sb</div> <div>Antimony</div> </div> <div> <div>52</div> <div>Te</div> <div>Tellurium</div> </div> <div> <div>53</div> <div>I</div> <div>Iodine</div> </div> <div> <div>54</div> <div>Xe</div> <div>Xenon</div> </div>																		<div> <div>55</div> <div>Cs</div> <div>Cesium</div> </div> <div> <div>56</div> <div>Ba</div> <div>Barium</div> </div> <div> <div>57</div> <div>La</div> <div>Lanthanum</div> </div> <div> <div>58</div> <div>Ce</div> <div>Cerium</div> </div> <div> <div>59</div> <div>Pr</div> <div>Praseodymium</div> </div> <div> <div>60</div> <div>Nd</div> <div>Neodymium</div> </div> <div> <div>61</div> <div>Pm</div> <div>Promethium</div> </div> <div> <div>62</div> <div>Sm</div> <div>Samarium</div> </div> <div> <div>63</div> <div>Eu</div> <div>Europium</div> </div> <div> <div>64</div> <div>Gd</div> <div>Gadolinium</div> </div> <div> <div>65</div> <div>Tb</div> <div>Terbium</div> </div> <div> <div>66</div> <div>Dy</div> <div>Dysprosium</div> </div> <div> <div>67</div> <div>Ho</div> <div>Holmium</div> </div> <div> <div>68</div> <div>Er</div> <div>Erbium</div> </div> <div> <div>69</div> <div>Tm</div> <div>Thulium</div> </div> <div> <div>70</div> <div>Yb</div> <div>Ytterbium</div> </div> <div> <div>71</div> <div>Lu</div> <div>Lutetium</div> </div>																	
<div> <div>73</div> <div>Ta</div> <div>Tantalum</div> </div> <div> <div>74</div> <div>W</div> <div>Tungsten</div> </div> <div> <div>75</div> <div>Re</div> <div>Rhenium</div> </div> <div> <div>76</div> <div>Os</div> <div>Osmium</div> </div> <div> <div>77</div> <div>Ir</div> <div>Iridium</div> </div> <div> <div>78</div> <div>Pt</div> <div>Platinum</div> </div> <div> <div>79</div> <div>Au</div> <div>Gold</div> </div> <div> <div>80</div> <div>Hg</div> <div>Mercury</div> </div> <div> <div>81</div> <div>Tl</div> <div>Thallium</div> </div> <div> <div>82</div> <div>Pb</div> <div>Lead</div> </div> <div> <div>83</div> <div>Bi</div> <div>Bismuth</div> </div> <div> <div>84</div> <div>Po</div> <div>Polonium</div> </div> <div> <div>85</div> <div>At</div> <div>Astatine</div> </div> <div> <div>86</div> <div>Rn</div> <div>Radon</div> </div>																		<div> <div>87</div> <div>Fr</div> <div>Francium</div> </div> <div> <div>88</div> <div>Ra</div> <div>Radium</div> </div> <div> <div>89</div> <div>Ac</div> <div>Actinium</div> </div> <div> <div>90</div> <div>Th</div> <div>Thorium</div> </div> <div> <div>91</div> <div>Pa</div> <div>Protactinium</div> </div> <div> <div>92</div> <div>U</div> <div>Uranium</div> </div> <div> <div>93</div> <div>Np</div> <div>Neptunium</div> </div> <div> <div>94</div> <div>Pu</div> <div>Plutonium</div> </div> <div> <div>95</div> <div>Am</div> <div>Americium</div> </div> <div> <div>96</div> <div>Cm</div> <div>Curium</div> </div> <div> <div>97</div> <div>Bk</div> <div>Berkelium</div> </div> <div> <div>98</div> <div>Cf</div> <div>Californium</div> </div> <div> <div>99</div> <div>Es</div> <div>Einsteinium</div> </div> <div> <div>100</div> <div>Fm</div> <div>Fermium</div> </div> <div> <div>101</div> <div>Md</div> <div>Mendelevium</div> </div> <div> <div>102</div> <div>No</div> <div>Nobelium</div> </div> <div> <div>103</div> <div>Lr</div> <div>Lawrencium</div> </div>																	
<div> <div>90</div> <div>Th</div> <div>Thorium</div> </div> <div> <div>91</div> <div>Pa</div> <div>Protactinium</div> </div> <div> <div>92</div> <div>U</div> <div>Uranium</div> </div> <div> <div>93</div> <div>Np</div> <div>Neptunium</div> </div> <div> <div>94</div> <div>Pu</div> <div>Plutonium</div> </div> <div> <div>95</div> <div>Am</div> <div>Americium</div> </div> <div> <div>96</div> <div>Cm</div> <div>Curium</div> </div> <div> <div>97</div> <div>Bk</div> <div>Berkelium</div> </div> <div> <div>98</div> <div>Cf</div> <div>Californium</div> </div> <div> <div>99</div> <div>Es</div> <div>Einsteinium</div> </div> <div> <div>100</div> <div>Fm</div> <div>Fermium</div> </div> <div> <div>101</div> <div>Md</div> <div>Mendelevium</div> </div> <div> <div>102</div> <div>No</div> <div>Nobelium</div> </div> <div> <div>103</div> <div>Lr</div> <div>Lawrencium</div> </div>																		<div> <div>104</div> <div>Rf</div> <div>Rutherfordium</div> </div> <div> <div>105</div> <div>Db</div> <div>Dubnium</div> </div> <div> <div>106</div> <div>Sg</div> <div>Seaborgium</div> </div> <div> <div>107</div> <div>Bh</div> <div>Berkelium</div> </div> <div> <div>108</div> <div>Hs</div> <div>Hassium</div> </div> <div> <div>109</div> <div>Mt</div> <div>Moscovium</div> </div> <div> <div>110</div> <div>Uun</div> <div>Ununnilium</div> </div> <div> <div>111</div> <div>Uuu</div> <div>Ununnilium</div> </div> <div> <div>112</div> <div>Uub</div> <div>Ununnilium</div> </div> <div> <div>113</div> <div>Uut</div> <div>Ununnilium</div> </div>																	

Source Emission Energies

Source Half-Life

Source

Fe⁵⁵ K-shell

Fe⁵⁵ L-shell

Cu⁶⁴ K-shell

Cu⁶⁴ L-shell

Au¹⁹⁷ K-shell

Am²⁴¹ L-shell

Co⁵⁷ K-shell

Cu⁶⁴ L-shell

Source

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Conversion

=



- X-ray fluorescent analysis detects elements present
- Software converts to a barcode and code of choice
- Can be matched with codes in other places

Nanocodes

If you had to put
a bar code inside
a softball,
then read it
through
the cover
how would you
do it?



**Let XRF Put the
Bar Codes Inside!!!**



















